CIA/PB 131632-144

UNCLASSIFIED- INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION - 1960

NOVEMBER 11 1960

PB - 144

PB 131632- 144

FDD
(69)

INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION - 1960

November 11, 1960

U. S. Department of Commerce
Business and Defense Services Administration
Office of Technical Services
Washington 25, D. C.

Published Weekly
Subscription Price $12.00 for the 1960 Series

Use of funds for printing this publication has been
approved by the Director of the Bureau of the Budget, October 28, 1959

INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM --

SOVIET-BLOC ACTIVITIES

Table of Contents | Page

I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

More Excerpts from the Soviet Press on the Third Anniversary of Sputnik I

Academician N. Sisakyan, writing in Izvestiya, reviews the conditions that man will face in a flight into space. He makes no statement concerning the imminence of such an event, but makes the following interesting statements.

"The influence of various kinds of radiation on the human body, especially cosmic radiation, has still been inadequately studied."

"Changes of the physiological condition of the body under conditions of weightlessness have still been studied inadequately."

These two statements seem to be at some variance with one of his earlier statements in this article: "The outstanding attainments of Soviet science and technology have prepared all the necessary prerequisites for the cosmic flight of man." ("Man and the Universe," by Academician N. Sisakyan, Izvestiya, 3 October 1960, p. 3)

Academician A. Blagonravov is the author of a 400-page review of the scientific attainments of Soviet space technology during the last three years. He sheds no new light on past events and makes no speculation on the future course of events. ("Three Years of Victories in Space," Academician A. Blagonravov, Izvestiya, 3 October 1960, p. 3)

Academician L. I. Sedov, also writing in Izvestiya, remarks that the problem of sending a man into space and safely recovering him has become the order of the day.

However, he states, it should be emphasized that in the next decade the principal means for the investigation of space, the Moon and the nearer planets will be the automatic interplanetary station connected to the Earth by radio.

For flights to Venus or Mars, he continues, the requirements for putting a space vehicle in the proper trajectory will be many times greater than is presently possible. He points out that an accuracy sufficient for hitting the Moon, situated 370,000 km from the Earth, can result in a miss of a million kilometers if the target is Mars. It is evident, says the author, that it will be necessary to use basically new systems for a hit on Mars or to circle Mars at a low altitude above its surface.

Great difficulties will arise in achieving radio contact over distances of several hundred million kilometers; our present experience is limited to distances of less than 30 million km. To solve the problems of radio communication we will also need new systems aboard the space vehicles and powerful receiving equipment on Earth.

Specialists clearly understand how difficult it is to implement proposals for flight to other planets. Therefore it is not surprising, he states, that at the present moment the problems of flight to other planets are not discussed seriously in scientific literature. ("The Door to Space is Open," L. I. Sedov, Izvestiya, 4 October 1960, p. 4)

II. UPPER ATMOSPHERE

Report on All-Union Conference on the Ionosphere

The following is a full translation of an article in a recent issue of Meteorologiya i Gidrologiya:

In April 1960 an All-Union Conference of the Working Group on the Ionosphere of the Interdepartmental Committee on the Conduct of the International Geophysical Year of the Presidium of the Academy of Sciences of the USSR was held in the Physics-Mathematics Department of Rostov-on-Don State University.

Taking part in the conference were associates of the Scientific Research Institute of Terrestrial Magnetism, the Ionosphere and Propagation of Radio Waves, Moscow, Tomsk and Gor'kiy State Universities, Khar'kov Polytechnic Institute, the Crimean Astrophysical Observatory, the Institute of Physics and Geophysics of the Academy of Sciences of the Turkmen SSR, and others. Also invited to the conference were workers of the North Caucasus Administration of the Hydrometeorological Service.

At this conference the participants summed up the results of ionospheric research during the period of the International Geophysical Year and International Geophysical Cooperation Program. A total of 24 reports and communications were delivered at the plenary and scientific sessions. In addition, three sections held meetings: a) vertical sounding; b) wind and inhomogeneities; c) absorption. A large number of papers was also studied at these sections.

A report was delivered at the scientific symposium by Prof. V. N. Kessenikh (Tomsk University). It was entitled "On Possible Mechanisms of Connection Between the Synoptic Ionosphere and Troposphere." It was of great interest to the representatives of the Hydrometeorological Service.

Prof. Kessenikh proposes to make a large-scale comparison between world synoptic maps of regional ionospheric anomalies and maps of barometric anomalies and study processes of circulation from the troposphere to the ionosphere, using data from vertical cross sections of the atmosphere (taking pressure and winds into consideration).

To study winds at various levels of the mesosphere and ionosphere it will be necessary to create artificial "reference clouds" observable by optical and radar methods. The creation of such "reference clouds" can be accomplished by the ejection of gaseous inclusions into the atmosphere from rockets at various altitudes.

Analyzing the data from ionospheric observations, the speaker observed that the F_2 layer for geographical areas with sharply expressed differences between summer and winter has a clearly defined seasonal "march."

For example, for Tomsk, Moscow, and Sverdlovsk a precise coincidence of the values of the maximum monthly median for the F_2 layer is extremely characteristic; this is due to a close climatic correspondence for these months.

Prof. Kessenikh noted the stabilizing importance of the winter Siberian anticyclone when the connection of the troposphere and ionosphere for a long period assumes a stable character, the character of statistical equilibrium. This is unquestionably reflected in the anomalous behavior of the F_2 layer over Siberia in the winter season (in comparison with Moscow).

The speaker pointed out the relationship between the climate of the ionosphere and the climate of the troposphere and suggested the possibility of establishing an "ionospheric climatology."

V. L. Lozigun (Rostov-on-Don State University) gave a report on the operation of the ionospheric station at the city of Rostov-on-Don. His report dealt with the drift of inhomogeneities. These observations were made by a comparison of the data of the Rostov-on-Don station with the results of wind observations in the stratosphere made by the aerological station of the Northern Caucasus Hydrometeorological Service. The speaker reported on the rather good coincidence between direction of movement of inhomogeneities in the sporadic E-layer and wind direction in the stratosphere. However, work has only begun; it should be continued not only at Rostov-on-Don, but also at other points.

The conference also examined problems relating to the organization of observations during the time of the forthcoming total eclipse of the Sun on 15 February 1961. ("On the All-Union Conference on the Ionosphere," by N. I. Popov, Meteorologiya i Gidrologiya, No. 9, 1960, p. 63)

Establishment of Space Station in the Georgian SSR

The following brief news item recently appeared in the Soviet press:

A high-mountain space station of the Institute of Physics of the Academy of Sciences of the Georgian SSR has been opened not far from the village of Tskhratskaro in Borzhomi Rayon at an elevation of 2,500 m above sea level. A unique electromagnet has been installed at this station. The total volume is six cubic meters. The magnetic field deflects the path of cosmic particles which are travelling at an immense velocity, changes their path and thereby traps them. ("What Happened Yesterday," Ekonomicheskaya Gazeta, 28 September 1960, p. 4)

New Equipment in Operation at Byurakan -- An "Izvestiya" News Dispatch

Yerevan, 4 October (by telephone from our correspondent). The All-Union Conference of Astrophysicists has concluded its work. The conference met in Byurakan, the astronomical center of the Academy of Sciences of the Armenian SSR, situated on the high slopes of Aragats.

Thirty reports were presented which dealt with the achievements of Soviet astrophysicists.

The installation of a meter telescope has now been completed at Byurakan. Use of this instrument presents to astrophysicists the possibility of penetrating still deeper into the secrets of phenomena in space. ("Meter Telescope," Izvestiya, 4 October 1960, p. 6)

American and Soviet Geological Maps of the Moon's Surface Compared

On 9 October Izvestiya reported the publication of a geological map of the Moon's surface. The person most responsible for its production is Aleksandr Vasil'yevich Khabakov. Khabakov has devoted almost a quarter of a century to the study of the Moon in addition to his principal activities at the Ministry of Geology and Conservation of Mineral Resources of the USSR. His objective has been an all-around and detailed comparative study of all features on the Moon's disk and the explanation of their physical peculiarities.

Mention is made of the XXI International Geological Congress, recently held in Copenhagen. Special attention is paid to the geological map of the Moon's surface prepared under the general supervision of Mason of the U.S. Geological Survey. The article indicates that this map was in many places similar or almost identical to the Soviet map. The American map was compiled considerably later than Khabakov's, but delineates only three stages in the formation of the lunar surface whereas the Russian map shows seven.

The Soviets see a "military-strategic special purpose" in the American map, but only purely scientific motivation in their own. ("The Geologist Goes...Over the Moon's Surface," by L. Golovanov, Izvestiya, 9 October 1960, p. 5)

Contribution to the Theory of Spectra of Radio Emission from Discrete Sources on Frequencies Below 30 mc/s

The reasons which can lead to a decrease in the intensity of the radio emission from discrete sources in the long waves (the absorption of radio waves in the interstellar medium and the sources themselves, the effect of the medium on the radiation of relativistic electrons, the variation of their energy spectrum due to ionization losses, and the reabsorption of radiation by relativistic electrons) are examined in an article by V. A. Razin, Scientific Research Radiophysics Institute, Gor'kiy State University. ("Contribution to the Theory of Spectra of Radio Emission from Discrete Sources on Frequencies Below 30 mc/s," by V. A. Razin; Gor'kiy, Izvestiya vsysshikh uchebnykh zavedeniy--Radiofizika, Vol 3, No 4, 1960, pp. 584-594)

Structure of the Heterogeneities and the Regular Magnetic Field of the Sun's Supercorona

The structure of heterogeneities and the regular magnetic field of the supercorona of the Sun are dealt with in an article by V. V. Vitkevich, Candidate of Physicomathematical Sciences, Physics Institute imeni P. N. Lebedev Academy of Sciences USSR, and a member of the Working Group on Solar Activity under the USSR National Committee for the IGY. Vitkevich describes the measurement of the magnitudes of the spectral scattering angle on the basis of observational data of radio emission from the Crab Nebula during the period it was covered by the Sun's supercorona. The observations were made with radio interferometers whose bases were oriented at different angles. An expression for the scattering angle of radio waves in the radial heterogeneities in the form of rays is worked out and its solution given. New versions are given on the effect of the supercorona on the apparent angular dimensions of the active regions of radio emission. An estimate on the magnitude of the regular magnetic field of the supercorona is also made. ("Structure of the Heterogeneities and Regular Magnetic Field of the Sun's Supercorona," by Viktor V. Vitkevich; Gor'kiy, Izvestiya vsysshikh uchebnykh zavedeniy--Radiofizika, Vol 3, No 4, 1960, pp. 595-605)

Method of Measuring Fluxes of Lunar and Solar Radiation

Absolute measurements of fluxes of lunar and solar radio emission involve great difficulties which are encountered in calibrating the separate units of the radio telescope. The process can be somewhat simplified by using the absorbing surface for obtaining one calibrating point, and further simplified by introducing two calibrating points found by using a flat antenna. The process of measuring consists of two stages, the determination of the antenna temperature while sighting on the source and the determination of the antenna temperature after the source's departure. An expression is derived. ("Method of Measuring Fluxes of the Radio Emission of the Moon and the Sun," by A. P. Molchanov, Main Astronomical Observatory, Academy of Sciences USSR; Gor'kiy, Izvestiya vysshikh uchebnykh zavedeniy--Radiofizika, Vol III, No 4, 1960, pp. 722-723)

Effects on Earth Currents Caused by High-Altitude Atomic Explosions

The first results of an analysis of short-period fluctuations of the earth's electromagnetic field caused by high-altitude atomic explosions in the South Atlantic (Operation "Argus") and in the Johnston Island region (Pacific Ocean) are presented. The analysis was made through rapid 24-hour recordings of earth currents with a scan of 30 mm/min carried out in the course of the IGY in the Arctic, the middle latitudes, and the Antarctic.

The USA conducted a series of high-altitude atomic explosions [1,2] in August-September 1958. Three of these, Argus I, II, III, were carried out at an altitude of about 500 km in the South Atlantic. Two explosions at a considerably lower altitude (below the ionosphere) were conducted in the Pacific Ocean in the region of Johnston Island. These high-altitude atomic explosions caused a number of geophysical phenomena -- disturbances in the earth's electromagnetic field, the ionosphere, the disruption of radio communication, and also auroras both at the point of the explosion as well as at a magnetically conjugate point [3-8].

A detailed analysis of these phenomena is of considerable interest since the first like observations can be attributed to a known source, namely, relativistic electrons arising as a result of β-decay during an explosion and trapped by the earth's magnetic field at a known moment and at a known point.

The results of this analysis will undoubtedly shed light on the mechanism exciting a number of natural types of electromagnetic disturbances.

High-Altitude Explosions, Argus I, II, and III

The officially reported data on the Argus explosions are presented in Table 1. [9]

TABLE 1

	Argus I	Argus II	Argus III
Force of explosion in kt	1-2	1-2	1-2
Date and approximate time of explosion GMT	27 Aug 1958 0230 hours	30 Aug 1958 0320 hours	6 Sept 1958 2210 hours
Coordinates of the points of the explosions	38 S 12 W	50 S 08 W	50 S 10 W

As is known [10], as a result of the Argus explosions a thin shell consisting of electrons was formed around the Earth. This shell it was found was located at a distance of about 6,400 km from the earth's surface in the slot between the inner and outer zones of natural radiation which were discovered with the aid of the satellites and cosmic rockets of Soviet and American scientists.

Thus, the effect of the entrapment of charged particles injected into any point in the upper atmosphere by the earth's magnetic field was experimentally demonstrated. The injection of charged particles into the upper atmosphere could have been accompanied, in accordance with present concepts, by short period fluctuations (KPK) of the electromagnetic field of the Earth. Actually, the spreading of the plasma originating during the explosion, causes magneto-hydrodynamic fluctuations in the magnetic field which can appear in the form of KPK of the electromagnetic field of the Earth [11]. The propagation of these fluctuations will occur according to the magnetic force lines in the conjugate areas and, possibly, according to ducts also located at a great altitude in the upper atmosphere and being in the first approximation of the shell, concentric with the Earth [12].

For explaining the mechanism of the generation of KPK of the electromagnetic field, of great value is an analysis of the scale of the geographic propagation of KPK excited from a single injection of charged particles at a known point; the investigation of the arrival times of the fluctuations at different geographic points with the aim of determining the propagation speeds of these disturbances; and the determination of the duration of the "transition" regime accompanying KPK.

In addition, the investigation of the periods of the excited fluctuations and the character of the change in amplitude depending on the location of the stations is of considerable interest.

It is now known that KPK of the earth's electromagnetic field excited during the Argus explosions were recorded by the network of French stations conducting observations of the magnetic field and earth currents in 1958 according to the IGY program [4], and also by 5 temporary American stations [12]. The observations conducted in [4] and [12] showed that KPK arising during the Argus explosions were observed with more or less intensity by stations in Europe, Africa, Antarctica, America and on Kerguelen Island and the Azores (the magnetically conjugate area for the explosions). The net of Soviet earth current stations operating in 1958 according to the IGY program, recorded the arrival of the KPK of the earth's electromagnetic field caused by all three high-altitude atomic explosions. (The effect was recorded on earth current apparatus with series-connected capacitance. The capacitance circuit was proposed by A. G. Ivanov in 1950.) The results of the analysis of these disturbances will be explained in this article.

The analysis of the recordings of earth currents by all stations shows that the most clearly recorded fluctuations in the majority of stations were those connected with the Argus II and Argus III explosions. The fluctuations connected with the Argus I explosion were low in intensity and undecipherable. Photocopies of the recordings of KPK connected with the Argus II and Argus III explosions made by a number of the stations are presented in Figures 1 and 2.

It should be mentioned that KPK connected with the Argus III explosion can be detected (sometimes only as a faint trace) in almost all the earth current stations including the arctic stations. The excitation of regular KPK with periods of 1-2 seconds in the final phase of the disturbance is an interesting morphological peculiarity of this disturbance of the field. Also of interest in this connection is that approximately a minute after the termination of the group of fluctuations we attributed to the Argus III explosion, weak but clear fluctuations with periods of 2-3 seconds occurred which continued for about 2 minutes. These facts can be of value in an examination of the mechanism of the propagation of disturbances from single injections. The arrival times of the fluctuations from the Argus II and Argus III explosions for a number of stations are given in Table 2.

An analysis of the arrival times of KPK shows that official data on the approximate times of the explosions which are given in [9] in the case of Argus II are later than the actual time of the explosion, but in the case of Argus III they are given as earlier than the actual time of the explosion. The arrival of fluctuations in the case of Argus I, as already mentioned, is indefinite, and falls approximately with the interval of 0227 to 0227:29 hours in the different stations. It should be noted that the character of the excited short-period fluctuations in the cases of Argus II and Argus III are clearly different. In the case of 6 September (Argus III), the excitation of more short-period fluctuations with periods of 1-2 seconds is characteristic. In addition, the first arrival, the second arrival, the main phase of the fluctuations and the gradual attenuation of fluctuations can be clearly distinguished on the recordings. The second arrival takes place on the average of about 2212:44 hours, with the main phase at about 2212:52 hours. It is interesting that at Alushta, the arrival ended with the characteristic series of fluctuations, reminiscent according to form and period, of the "loop" type fluctuations frequently observed in the earth's natural electromagnetic field. The 30 August (Argus II) incident is characterized by less regular fluctuations with a large period ($T \sim 2$-3-4 seconds). This difference in the type and periods of fluctuations may be connected with the fact that between 30 August and 6 September a large magnetic storm occurred (4 September 1958) which undoubtedly changed the state of the upper charged layers of the atmosphere.

The amplitude of the signals at the different stations is from a fraction to ten millivolts per kilometer in both cases. In addition, the order of amplitude is typical for fluctuations of the natural electromagnetic field for those same periods at the given station. A comparison of the arrival times with the data obtained by the French stations [4], indicates a sufficiently close agreement of the arrival time of the fluctuations by the Soviet and French stations in Antarctica (Dumont d'Urville and Charcot) in the case of Argus II. The deviation is about one second with a correction in the time for the French station of +1 second and ± 0.5 seconds for the Soviet stations.

In the case of Argus III, the impression was created that the first arrival was not recorded at the French stations. At the Soviet stations, the time of the second arrival coincided, within plus-minus three seconds, with the arrival of the fluctuations at the French stations in the Antarctic and those near Paris.

The arrival time of the fluctuations at "Kerguelen" station coincides with the arrival of the main phase of the fluctuations at the Soviet stations. Unfortunately, the obtained arrival times of KPK cannot be compared with the data obtained in the region of the Azores, in the USA and in Northern Europe [12] by American scientists [2,12], since the articles do not indicate what the actual arrival times were, and give only the difference between the moment of explosion and the arrival time. The time of the explosion is not given.

TABLE 2

Station	Arrival Time	
	Argus II, 30 August 1958	
Mirnyy	0317	33 plus-minus 0.5 sec
Borok	0317	34 plus-minus 0.5 sec
Shatsk	-	-
Alushta	0317	34.6 plus-minus 0.5 sec
Alma Ata	0317	34.6 plus-minus 0.5 sec
Lovozero	0317	34 plus-minus 0.5 sec
	Argus III	
Mirnyy	no recording made	
Borok	2212	36.7 plus-minus 0.5 sec
Shatsk	2212	36 plus-minus 0.5 sec
Alushta	2212	36 plus-minus 0.5 sec
Alma Ata	2212	36.6 plus-minus 0.5 sec
Lovozero	2212	36.8 plus-minus 0.5 sec
Piramida	2212	37 plus-minus 0.5 sec
M. Chelyuskin	2212	38 plus-minus 0.5 sec
Yu. Sakhalinsk	2212	35 plus-minus 2 sec
Kheyss	2212	37.5 plus-minus 0.5 sec

Nevertheless, to judge by the fact that the first arrival, as is given in [2,12], was recorded between the fourth and sixth second after the explosion, and the difference in time between the first and second arrivals of KPK at the Soviet stations was also equal to 4-7 seconds, it is possible to assume that the first arrival of the small type of pulse (Figure 2 -- "Alushta"), which evidently was not recorded by the French and American stations, corresponds to the time of the explosion. The second arrival of KPK at the Soviet stations in the case of Argus III probably corresponds to the majority of cases of arrivals recorded in the literature. It stands to reason that an exact identification of the various arrivals and fluctuations is possible only by a comparison of the original recordings of the various stations.

All of the above data indicate that a single injection of charged particles into the upper atmosphere produces a perturbation of the KPK group over practically the entire surface of the earth. The rate of propagation of these fluctuations either coincides with the speed of light or considerably exceeds the ordinarily assumed rate of propagation of magnetohydrodynamic waves. Thus KPK is a delicate indicator of the injection of charged particles into the upper atmosphere, and their activity, in the case of a natural field, indicates the frequency and duration of injections of clouds and streams of charged particles from cosmic space.

Atomic Explosions in the Region of Johnston Island

(φ = 16.7, λ = 169.4)

Atomic explosions in the region of Johnston Island (1 and 12 August 1958) were conducted at altitudes substantially below the ionosphere. The explosion of 1 August was not accompanied by any characteristic short-period fluctuations which could have been connected with certainty with this explosion. The explosion of 12 August (1030 hours -- according to official information) caused a disturbance of a small single "peak" type with a duration of approximately 6 seconds. Photocopies of recordings for this case are given in Figure 3 (for the "Petropavlovskna-Kamchatke" and "Alma Ata" stations). This effect was recorded at a number of stations (Table 3) and was noted as a trace at the "Oazis" station in the Antarctic. The arrival times of this disturbance at various stations are given in Table 3.

Even in this case an analysis of the arrival times shows that the signal was instantaneously propagated over a vast territory. This draws attention to the fact that the type of short-duration fluctuations caused by the injection of charged particles below the ionosphere (Johnston) and above it (Argus) is substantially different. In the case of explosions above the ionosphere, recordings were made of series of comparatively regular fluctuations with periods of 1-2 seconds and a duration of approximately 50-60 seconds for the case of Argus III, and series of less regular fluctuations with periods of 2-4 seconds and a duration of approximately 30-40 seconds ("Borok," "Alushta") for the case of Argus II.

For the explosion of 12 August, which occurred below the ionosphere, the effect had the character of a single splash. The amplitude of this splash was equal to 1 mv/km at "Alma Ata" and 0.5 mv/km at "Petropavlovsk-na-Kamchatke." It is interesting to note that for the Johnston explosion (with an equivalent power of approximately 1 megaton) a number of stations located in the region of the explosion observed microbay-type of disturbances of the magnetic field [6]. For the Argus sub-ionospheric explosions,

TABLE 3

Station	Arrival Time 10 o'clock dmt	Remarks
Petropavlovsk	Johnston, 12 Aug 1958 30 m. 07 s ± 0.5 s	
Alma Ata	30 m. 0.85 ± 0.5	
Borok	30 m. 08.1 ± 0.5	Signal weak
Oazis	30 m. 09 ± 0.5	Signal weak but very clear

Macroscopic disturbances of the magnetic field were not detected. This fact again points out that processes in the upper atmosphere, above the ionosphere, are reflected for the most part in short-period fluctuations of the earth's electromagnetic field. Thus, study of the KPK of the earth's electromagnetic field is probably one of the more indirect methods of studying the upper atmosphere.

A more detailed analysis of KPK appearances at different stations caused by atomic explosions will be given in future articles.

In conclusion I consider it my duty to thank the workers and heads of earth current stations who, during the IGY, made around-the-clock rapid recordings of earth currents which permitted detection of the phenomena described above -- I. I. Rakityanskiy, M. V. Okhatsinskaya, K. Yu. Zubin, R. V. Shchepetnov, V. V. Novysh and I. Plyashkevich.

BIBLIOGRAPHY

1. Porter, W., Symposium on scientific effects of artificially introduced radiations at high altitudes, J. Geophys. Res., 64, No 8, 1959.
2. Matsuchita, S., On artificial geomagnetic and ionospheric storms associated with high-altitude explosions, J. Geophys. Res., 64, No 9, 1959.
3. Peterson, A. M., Newman, P., Optical, electromagnetic and satellite observations of high-altitude nuclear detonations, J. Geophys. Res., 64, No 8, 1959.
4. Selzer, E., Enregistrements simultanés en France, à l'Equateur et dans l Antarctique des effets magnétiqulls engendrés par "l'Experience Argus." Compt. rend., 249, No. 13, 1959.
5. Cummack, C. H., King, G. A. M., Disturbance in the ionospheric F-Region following the Johnston Island nuclear explosion, Nature, 184, No. 4688, 1959.
6. Matsuchita, S., Geomagnetic and ionospheric phenomena associated with nuclear explosions, Nature, 184, No. 4688, 1959.
7. Lawrie, J. S., Gerard, V. B., Gill, P. G., Magnetic effects resulting from two high altitude nuclear explosions, Nature, 184, No. 4688, 1959.
8. Mason, R. C., Vitonsek, M. J., Some geomagnetic phenomena associated with nuclear explosions, Nature, 184, No. 4688, 1959.
9. Barsukov, O. M., Tropitskaya, V. A., Soviet Terrestrial Magnetism Stations, Izd. ANSSSR, Ser. MGG (Publications, Academy of Sciences USSR, Geomagnetism Series [?]), 1959.
10. Van Allen, J. A., McIlwain, C. E., Ludwig, G. H., Satellite observations of electrons artificially injected into the geomagnetic field, J. Geophys. Res., 64, No. 8, 1959.
11. Leypunskiy, O. I., The possible magnetic effect of high-altitude atomic explosions, Zh. A.T.F. (Journal, Academy of Theoretical Physics), 38, No. 1, 1960.
12. Bomke, H. A., Ramm, W. J., Goldblatt, S., Klemas, V., Global hydromagnetic wave ducts in the exosphere.

("Effects in Earth Currents Caused by High-Altitude Atomic Explosions," by V. A. Tropitskaya, Inst. of the Physics of the Earth, Acad. Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 9, 1960, pp 1321-1327)

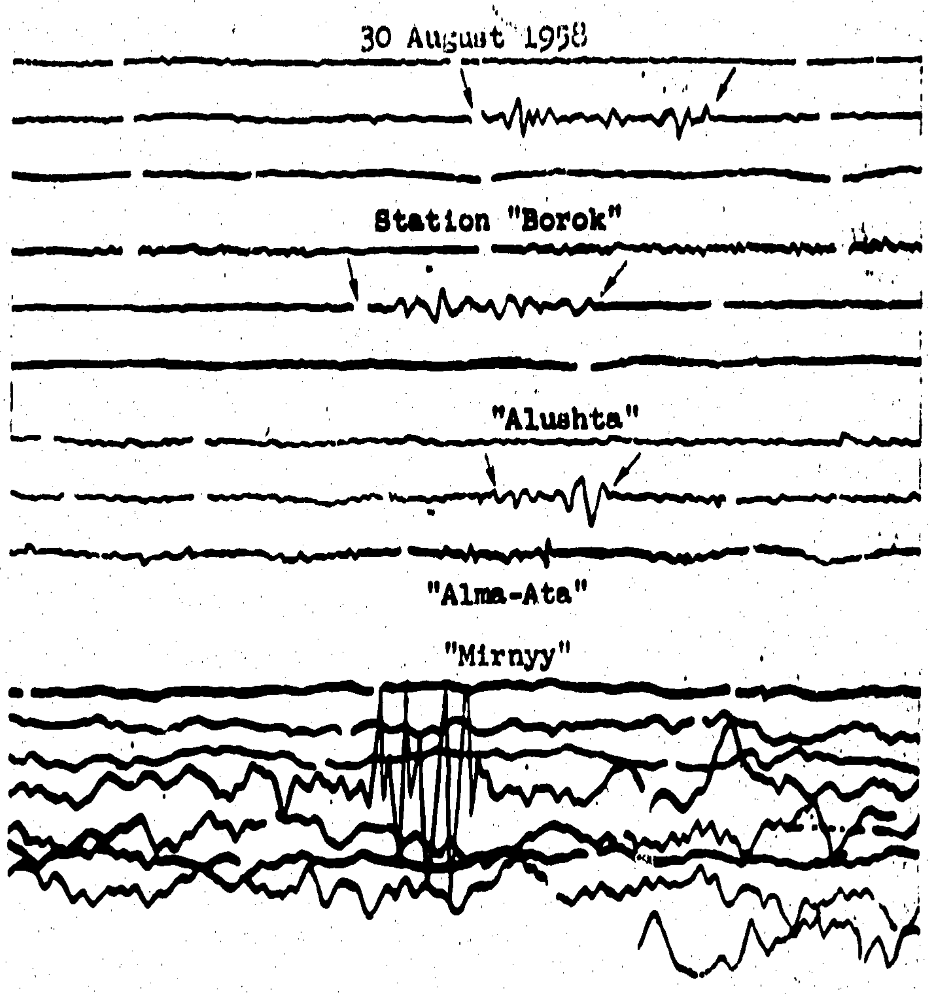

Figure 1

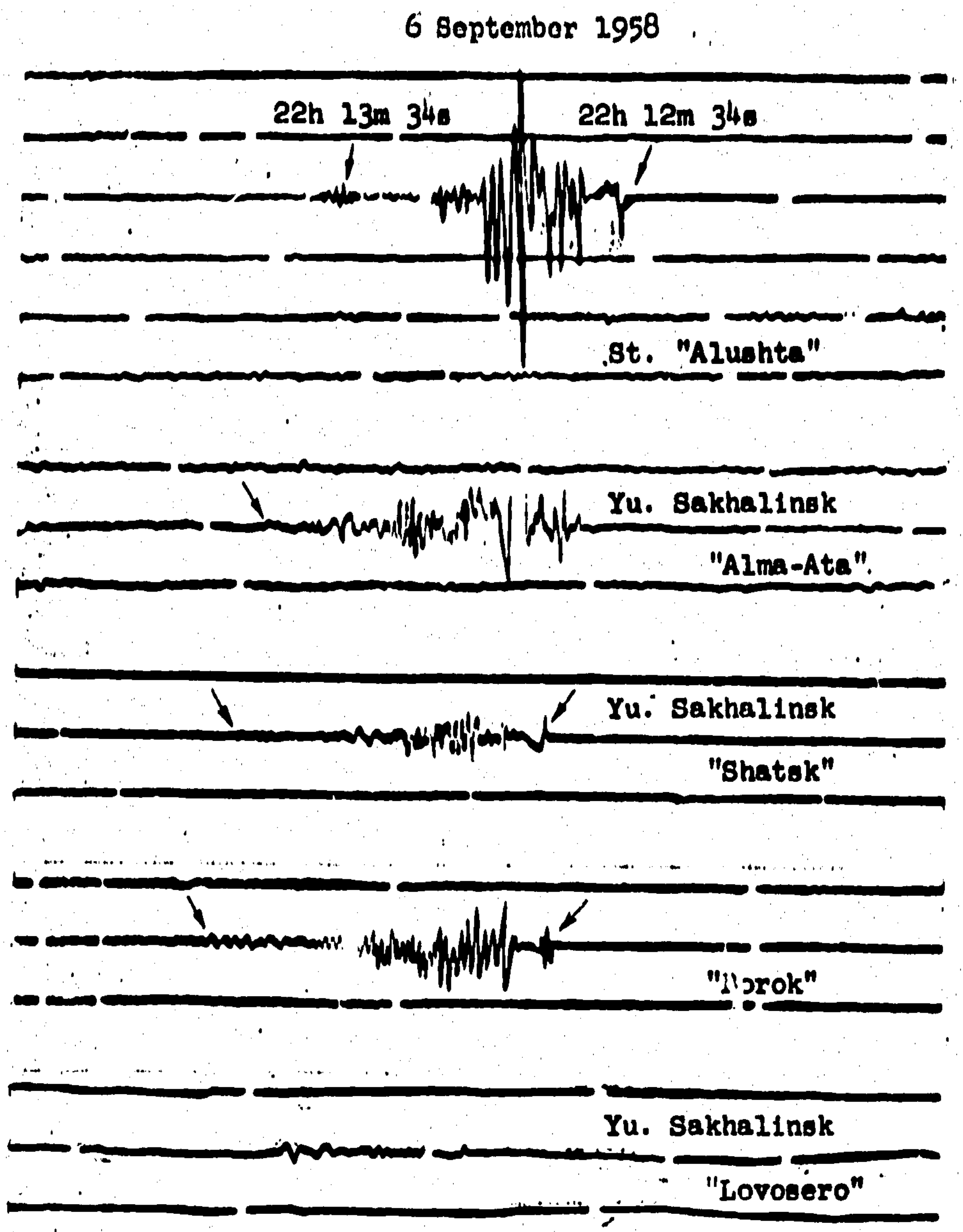

Figure 2

Approved For Release 1999/09/08 : CIA-RDP82-00141R000201440001-3

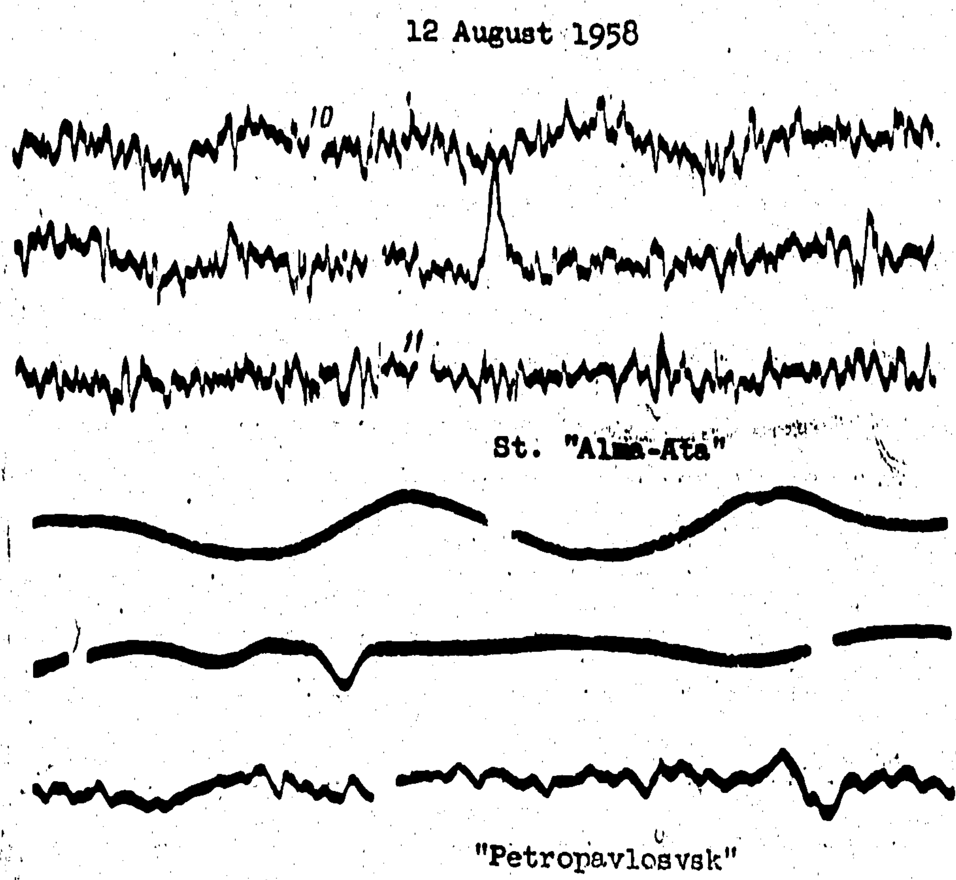

Figure 3

III. METEOROLOGY

Methods for Processing Signals from the A-22-III Radiosonde

The new A-22-III radiosonde was introduced at some stations of the USSR aerological network in 1958. The design of this instrument and the principles involved in processing its recorded signals have been described by Pobiyakho in an article in Meteorologiya i Gidrologiya (No. 8, 1959).

The present method of processing recordings is extremely tedious and has required speeding up and simplification. This article describes and illustrates several devices for use in accomplishing these objectives. ("On Ways of Improving the Methods for Processing Signals from the A-22-III Radiosonde," by R. O. Tydel'skaya, Meteorologiya i Gidrologiya, No. 9, 1960, pp. 35-38)

IV. OCEANOGRAPHY

Experimentation with a New Device for Measuring the Salinity of Sea Water

In 1957-1958 the Black Sea Station of the Institute of Oceanology of the Academy of Sciences of the USSR made experiments with the ES-57 electric salinity gauge. The instrument is shown in Figure 1. It is designed for the measurement of salinity of samples of sea water under expeditionary conditions. The salinity range is from 2% to 40%. Determination of salinity is based on the resistance of an electrolytic cell, a vessel with platinum electrodes, filled with a sample of sea water. The article describes the procedures used in making determinations. Because the electrical conductivity of water depends not only on its salt content, but also on its temperature, special compensations were required to deal with this difficult problem; the article describes the steps taken to overcome this difficulty.

Accuracy of measurement appears to be ±0.04%; it will handle 15 to 18 samples per hour. ("Experimentation with the ES-57 Electric Salinity Gauge," by A. A. Visnevskiy, Meteorologiya i Gidrologiya, No. 9, 1960, pp. 38-40)

On the Use of Aerial Methods in Oceanography

A recent article in Meteorologiya i Gidrologiya constitutes a critical assessment of an article by N. N. Lazarenko published in Issue 37 of the Works of the State Oceanographic Institute (1959). Lazarenko's article was entitled "On the Problem of the Use of Aerial Methods in Oceanographic Research." Lazarenko proposed that the position of a plane making oceanographic observations be determined by intersection by using theodolites set up at shore stations with known coordinates. He asserted that the plane would be visible, under certain conditions, for 60 km, or even as much as 150 km.

The authors of this review proceed to attack and demolish Lazarenko's assertions on this point -- the maximum visibility, they state, is 50 km. Lazarenko's statement that air surveys are useful in solving certain problems associated with heavy seas is also full of loopholes, they continue, since such seas usually occur in stormy weather when visibility conditions are poor. Moreover, theodolites are valueless for the purpose stated under any conditions.

In summation, the authors declare that all of Lazarenko's basic assumptions are wrong and without applicability to the solution of any problem. ("On the Use of Aerial Methods in Oceanography," by I. A. Cherkasov and V. G. Zdanovich, Meteorologiya i Gidrologiya, No. 9, 1960, pp. 52-54)

V. ARCTIC AND ANTARCTIC

Report on Arctic Flights

The following is the text of a recent news article in Pravda:

A test flight has been made to the ice air strips drifting in the central basin of the Arctic Ocean with the scientific drift stations "Severnyy Polyus-8" and "Severnyy Polyus-9." Fliers of polar aviation Mikhail Titlov, Hero of the Soviet Union, and Viktor Kubyshkin have delivered mail and food to the polar specialists. The flight was made in the polar night under difficult meteorological conditions.

("Flights to the Pole," Pravda, 12 October 1960, p. 6)

New Work on Opening Ice-Locked Northern Harbors; the Sixth Antarctic Expedition in Final Stages of Preparation

A recent feature article in Pravda reports on the latest activities of the Institute of the Arctic and Antarctic. The polar specialist Pavel Afanas'yevich Gordiyenko is quoted as follows:

"The staff of the Institute has now set about the solution of an important problem in the national economy of our country. As is well known, the ports of Leningrad, Riga, Arkhangel'sk, Zhdanov, Nagayevo and Vanino must suspend operations every winter or decrease the volume of cargo handled because of severe ice conditions. To prolong the navigation period in non-Arctic ice-locked ports our scientists are helping to introduce ways to lead ships through the ice on approach to these ports. Moreover, the problem is being faced of working out engineering and technical procedures which will retard the formation of ice in ports or permit the making of a channel for leading through ships by utilizing the latest technological advances."

"It is very important to prolong the navigation period in the Arctic, in particular at the mouth of the Yenisei and through Vil'kitskiy Strait. This will give an outlet for a colossal volume of freight from Siberia and will lead to the extremely rapid development of that wealthy region. The present-day achievements of science and our powerful ice-breaker fleet headed by the atomic-powered "Lenin" are making the solution of the problem completely viable."

The Chief of the Antarctic Division of the Institute, Aleksey Fedorovich Treshnikov, Hero of Socialist Labor, is quoted as follows:

"The great work of preparing a new expedition is now being completed at the Arctic and Antarctic Institute. It will be headed by V. M. Driatskiy, Candidate in Geographical Sciences.

"The Sixth Soviet Expedition will continue the work in the study of the Antarctic begun in the period of the International Geophysical Year. It consists of a continental wintering expedition and geological and naval detachments. The staffing of the expedition is essentially completed. The majority of the participants on this expedition will be experienced polar specialists, many going to the Antarctic for the second or third time.

"The diesel-electric Ob' on which the expedition will sail will first go to Lazarev... that station, situated on the shelf ice, will be moved to facilitate the conduct of scientific research. It is being resited 100 to 200 km from the coast of the continent.

"A great complex of aerometeorological research...will be accomplished by scientists under the direction of V. I. Shlyakhov, Candidate in Physical-Mathematical Sciences. New radiosondes will be used in investigation of the high layers of the atmosphere.

"The geographical detachment, directed by V. B. Smirnov, Candidate in Technical Sciences, will conduct an extensive program."

("Revealing the Secrets of Icy Deserts," by B. Markov and N. Il'inskiy, Pravda, 5 October 1960, p. 6)

"The Active Method of Study of Natural Conditions in the Central Arctic"

The 15-page lead article in the April 1960 issue of the Izvestiya of the All-Union Geographical Society is an invaluable document. It constitutes an important summarization of Arctic research by the Soviets and contains a wealth of condensed factual material not as readily accessible elsewhere.

Table 1 is a listing of all the Soviet "Severnyy Polyus" drift stations since the very first in 1937-1938 under the direction of I. D. Papanin. It is carried down to the "SP-8" and "SP-9" which are still adrift. In all, small groups of Russian scientists have worked over 5,000 drift-days on these stations. They have travelled over 31,000 km on the drifting ice. The table lists each station, its leader, the initial and final dates of occupance, the total number of days of drift, the initial and final coordinates, the length of drift in km (total and in straight-line distance), and the average rate of movement in km per day (total and in straight-line distance). Figure 1 is a fold-out map showing the routes followed by the first eight drift stations. Table 2 is a listing of the number of scientific workers on each station, broken down by field of specialization. Table 3 is a listing of the high-latitude expeditions operating from the "SP" stations, the sponsor of the expedition, number of participants, duration of their work, their leaders, and the scientific fields investigated.

In recent years the researchers have annually made 1,000 to 1,400 measurements of the depth of the ocean, 1,000 to 1,500 measurements of water temperature at various horizons in the ocean, a similar number of analyses of the chemical composition of its waters at various depths, about 3,000 basic meteorological observations, 1,900 to 2,500 series of actinometric observations, about 300 standard magnetic determinations (automatic magnetic stations recorded elements of the magnetic field for about 8,200 hours per year), and over 800 launchings of radiosondes with radar tracking. Each year there have also been hundreds of determinations of elements of the drift of the ice, measurements of ice thickness and depth of snow, determinations of their structure and temperature, and a great number of other phenomena.

The article describes in considerable detail the reasons behind this vigorous Soviet investigation of the Arctic. The Northern Sea Route was at first an important motive, especially when it was discovered that ice conditions in the Arctic basin were subject to pronounced season-to-season and year-to-year variations, and that knowledge of the "mean" or "prevailing" conditions was of little practical value.

After listing in detail the various fields of investigation covered by the polar researchers, the article stresses the great demands placed on the polar workers. Each is competent to work in not just one field, but in two or three. They work no less than 11 or 12 hours a day under the most trying conditions.

Nevertheless, the number of personnel on each station has decreased in recent years. This has been made possible by rationalization and automation. A part of the article is devoted to new instruments and methods developed at the Arctic and Antarctic Institute to make observations easier, facilitate a greater volume of observations, and improvement in their quality. There is first a detailed discussion of innovations in housing, heating, clothing, transportation and the camp itself. The article then proceeds to a discussion of the new instruments and equipment developed for making observations under these difficult conditions: water close to the freezing point; low air temperatures; air filled with wind-blown snow; the ice floe constantly moving; a limited area in which to work; summer thawing of the ground underfoot; the limited weight and dimensions of equipment which can be air-lifted; frequent winds of gale force; snow drifts; the darkness of the polar night; flooding on the ice floe during summer thaws.

Among these instruments are the following:

1) An automatic device for the continual (hourly) recording of the velocity and direction of currents at various horizons in the ocean to depths of 1,000 meters. It will operate unattended for 1 and 1/2 to 2 months. It has completely replaced older devices and the number of observations has increased tenfold.

2) A bifilar electric current recorder for the surface layers of the ocean. Current readings show on a panel inside the observer's hut. It does the work of 3 or 4 full-time hydrologists.

3) A miniature bathometer which takes samples of sea water from any depth.

4) A bottom sampler which is portable, simple in design and reliable.

5) An electric resistance thermometer for ice temperature measurement.

6) An ice-sounding lead which makes it possible to easily measure great thicknesses of pack ice.

7) An automatic self-recording sounding device which has eliminated manual soundings and has increased by dozens of times the data collected on bottom relief.

8) A deep-water oceanographic winch. Portable (80 kg) and capable of being dismantled. Makes possible observations to depths of 5,000 m. Used with an electric motor or manually.

9) A self-recording ionospheric instrument called the "Efir," used for the vertical sounding of the ionosphere every half-hour. Uses direct or alternating current.

10) A magnetic variation station for continually making a photo-recording of the three components of the Earth's magnetic field. Battery-operated. If replaced by visual readings there would be need for a threefold increase in observers.

11) The S-80 camera for photographing auroras. Records auroras in all parts of the heavens at a rate of 1 to 3 photos per minute. Battery-operated.

12) A variety of instruments for actinometric measurements: a) an under-snow pyranometer for measurement of solar radiation penetrating under the snow; b) an under-snow relative photometer for measurement of illumination on the surface and in the snow cover; c) an under-ice and under-water device ("PIOR") for measuring radiation and illumination; d) an underwater photopyranometer (NMS-2) for measurement of underwater radiation and illumination.

This by no means exhausts the list of instruments developed for Arctic use and mentioned in the article. As a result of rationalization and automation not only has it been possible to decrease the staff, but current (1960) expenditures on station maintenance is only half that of the 1954/1955 period. Nevertheless many observations are still made laboriously and with low productivity.

The final part of the article is a summation of the most important results of scientific research on the drift stations. Such subjects as the following are discussed: bottom relief and bottom deposits (Figure 2 is a fold-out map of the bottom relief of the Arctic basin); currents; actinometric observations; weather and climate; magnetic observations; problems of radio communication. ("Active Method of Study of the Natural Conditions of the Central Arctic," by P. A. Gordiyenko, Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva, No. 4, 1960, pp. 293-307)

US COMM-DC